

DESIGN GUIDELINES APPROVED FOR USE IN DESIGNING WATER CROSSINGS OVER FISH-BEARING WATERS IN WASHINGTON STATE

These crossing design guidelines are approved for use over fish-bearing waters in Washington and, when used correctly, fulfill many of the provisions in WAC 220-660-190 or -200. Since Washington has a higher level of protection for fish than most jurisdictions, guidelines written for a national or international audience, or for another state, will have to be used with caution so that the crossing design does not violate state law. These guidelines have been evaluated using the **Procedure For Using Alternative Methods To Design Water Crossings Over Fish-Bearing Waters** with these principles in mind:

- Design cannot be based solely on cost and safety concerns but must also consider the protection of fishlife and their habitat. Fish habitat is created and maintained by normal, expected stream processes. Design methods must address the evolution of the channel profile and planform; the movement and staging of sediment and debris; and the preservation or development of natural banks and riparian zone.
- The design method must specifically consider fish passage. As expressed in WAC 220-660-190, passage must be provided for all fish. Passage is defined as the prevailing conditions in the adjacent natural channel not on the swimming or jumping ability of a specific species.

Approved Guidelines with notes for use

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3. Love, M. and K. Bates (2010). [Part XII: Fish Passage Design and Implementation](#). California Salmonid Stream Habitat Restoration Manual. California Dept. of Fish and Game. 188 pp.
4. Clarkin, K., G. Keller, et al. (2006). [Low-water crossings: geomorphic, biological, and engineering design considerations](#). San Dimas, CA, U. S. Department of Agriculture, Forest Service.
5. Federal Highway Administration, [Context Sensitive Solutions](#). www.fhwa.dot.gov/context/index.cfm
6. Forest Service Stream-Simulation Working Group, Ed. (2008). [Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings](#). National Technology and Development Program, San Dimas, CA, U.S. Department of Agriculture, Forest Service National Technology and Development Program.

7. Keller, G. and J. Sherar (2003). [Low-volume Roads Engineering, Best Management Practices Field Guide](#), US Agency for International Development, USDA Forest Service, Virginia Polytechnic Institute and State University.
8. Kilgore, R. T., Bart S. Bergendahl, and Rollin H. Hotchkiss (2010). [Culvert Design for Aquatic Organism Passage](#). FHWA-HIF-11-008 HEC- 26, U.S. Dept. of Transportation, Federal Highway Administration, 234 p.
9. Nordlund, B. (2011). [Anadromous salmonid passage facility design](#), National Marine Fisheries Service Northwest Region: 37 pgs.
10. Richardson, E. V., D. B. Simons, et al. (2001). [River engineering for highway encroachments, Highways in the river environment](#). Washington D. C., U. S. Dept. of Transportation, Federal Highway Administration. Hydraulic Design Series Number 6: 644.
11. Sirofchuck, S. E ed (2011). [Code of Federal Regulations, Title 23, Highways](#). U. S. Office of the Federal Register National Archives and Records Administration, 638 p.
12. WADNR (2013). Forest Practices Board Manual, Section 5 [Guidelines for Forest Practices Hydraulic Projects](#). Washington Dept. of Natural Resources, Olympia, WA. 60 p.
13. WSDOT (2010). [Hydraulics Manual](#), version M 23-03.03. Washington Dept. of Transportation, 378 p. (Chapter 7 Fish Passage)
14. WSDOT (2014). [Design Manual](#), version M 22-01.11. Washington Dept. of Transportation. (Chapter 800 Hydraulic Design)